*decades. Further alteration could reduce the capacity of the Delta to support native fishes.*

*Every reasonable effort should be made to reduce the introduction of non-native organisms at border crossings into California. Border inspections have already found zebra mussels, which, if allowed to enter Bay-Delta waters, could have devastating economic and ecological effects.*

## Invasive Riparian and Marsh Plants

**Target 1:** Reduce by 50% the area covered by invasive non-native woody species, such as giant reed and eucalyptus, that compete with native riparian vegetation, and eradicate invasive woody plants from restoration areas (◆◆◆).

**Programmatic Action 1a:** Develop a cooperative program to remove and suppress invasive non-native plants that compete with native riparian vegetation by reducing the area occupied by these species (such as giant reed and eucalyptus) by 50%.

**Programmatic Action 1b:** Develop a cooperative program to eliminate invasive woody plants from restoration sites to protect native riparian vegetation.

**Programmatic Action 1c:** Develop a cooperative program to develop control measures for perennial pepperweed.

***Rationale:*** *Invasive non-native plants have altered ecosystem processes, functions, and habitats by modifying the foodweb and competing for nutrients, light, and space (Dudley and D'Antonio 1994, Madrone Associates 1980, Bay-Delta Oversight Council 1994, Cross and Fleming 1989, and Zedler 1992).*

## Non-Native Wildlife

**Target 1:** Reduce red fox and feral cat populations in and adjacent to habitat areas suitable for California clapper rail, California black rail, and salt marsh harvest mouse (◆◆).

**Programmatic Action 1a:** Develop a cooperative program to evaluate means to reduce red fox and feral cat populations through trapping, relocation, fertility control, or other suitable measures.

**Programmatic Action 1b:** Develop and implement a public education program that emphasizes the ecological value of maintain coyote populations.

***Rationale:*** *The large-scale restoration of emergent wetlands, riparian habitat, and adjacent perennial grasslands will be the main focus of a strategy to reduce the adverse impacts of non-native wildlife on the health of the Bay-Delta ecosystem. The goal is a restored Bay-Delta and watershed where the quality, quantity, and structure of the restored habitat discourage colonization by non-native wildlife, provide a competitive advantage to native wildlife, and reduce the vulnerability of native species from predation by species such as the red fox and feral cat. A public education program to inform duck club owners of the ecological importance of native coyotes in the Suisun region may help prevent the potentially devastating spread of red fox further into the Suisun Marsh and Delta region. Coyotes are native to the region and tend to keep foxes from increasing their range.*

*One of the most serious environmental problems facing California is the explosive invasion of non-native pest plants and animals. Non-native plants, wildlife, fish, and aquatic invertebrates can greatly alter the ecosystem processes, functions, habitats, species diversity, and abundance of native plants, fish, and wildlife.*

*Many of these invasive species spread rapidly and form dense populations primarily by out-competing native species as a result of large-scale habitat changes that tend to favor non-native species and a lack of natural controls (e.g., natural predators). These non-native species usually have a competitive advantage because of their location in hospitable environments where the normal controls of disease and natural enemies are missing. As populations of non-native species grow, they can disrupt the ecosystem and population dynamics of native species. In some cases, habitat changes have eliminated connectivity of habitats that harbor the native predators that could help to limit populations of harmful non-native species.*

## Predation and Competition

**Target 1:** Limit striped bass supplementation to life stages that minimize predation on juvenile anadromous and estuarine fish (◆◆◆).

**PROGRAMMATIC ACTION 1A:** Provide sufficient equipment, support staff, and operation and maintenance funds to hold juvenile striped bass longer so they can be planted at 2 years of age instead of 1 year.

**PROGRAMMATIC ACTION 1B:** Cooperatively develop an ecologically based approach to limit striped bass and chinook salmon stocking in the Bay to areas and periods that will not increase predation on special-status species, such as longfin smelt and delta smelt, and other native fishes.

***RATIONALE:*** *Actions taken in this Ecological Management Zone are prescribed to protect populations of aquatic species, such as longfin smelt, and delta smelt, from excessive predation rates caused by large concentrations of stocked hatchery-reared fish. Limited studies have shown that two-year-old striped bass have less of an impact on anadromous and estuarine fish than one-year-old striped bass.*

## CONTAMINANTS

**TARGET 1:** Reduce the input of herbicides, pesticides, fumigants, and other agents toxic to fish and wildlife in the Suisun Marsh/North San Francisco Bay Ecological Management Zone (◆).

**PROGRAMMATIC ACTION 1A:** Support programs already in place to regulate the discharge of pollutants or reduce pollutant toxicity in Bay waters.

***RATIONALE:*** *Reducing the concentrations and loads of contaminants, including hydrocarbons, heavy metals, and other pollutants, in the water and sediments of the Suisun Marsh/North San Francisco Bay Ecological Management Zone will help reduce sublethal and long-term impacts of specific contaminants for which it is difficult to document population-level impacts conclusively. Reducing loading in urban runoff and modifying agricultural practices and land uses on a large scale will reduce pesticide residue concentrations through a combined approach. This approach involves reducing the amount of pesticide applied and the amount reaching the Bay's aquatic habitats. This will be done by biological and chemical processes in wetland systems that break down harmful pesticide residues. (Bay Delta Oversight Council 1994, Hall 1991, U.S. Fish and Wildlife Service 1996, San Francisco Estuary Project 1992b, Resources Agency 1976, Sparks 1992, Diamond et al. 1993, and Rost et al. 1989).*

*Improved inchannel flows in the Delta resulting from seasonal reductions in water use and enhanced environmental water supplies will also help to reduce concentrations (San Francisco Estuary Project 1992a). Health warnings have been issued regarding human consumption of fish and wildlife because of elevated levels of substances, such as mercury and selenium. Large-scale aquatic and wetland habitats restoration may help to resolve concerns about hydrocarbons, heavy metals, and other pollutants. Addressing point sources of concern, such as the oil refineries in Suisun and San Francisco Bays, and elevated releases of selenium resulting from refining oil from sources high in selenium, can be effective elements of a strategy to achieve the desired reductions.*

## HARVEST OF FISH AND WILDLIFE

**TARGET 1:** Reduce illegal anadromous fish and waterfowl harvest in Suisun Marsh and San Francisco Bay by increasing enforcement and public education (◆◆◆).

**PROGRAMMATIC ACTION 1A:** Provide additional funding to California Department of Fish and Game (DFG) for additional enforcement.

**PROGRAMMATIC ACTION 1B:** Provide additional funding to county sheriff's departments and State and local park agencies to support additional enforcement efforts.

**PROGRAMMATIC ACTION 1C:** Provide rewards for the arrest and conviction of poachers.

**PROGRAMMATIC ACTION 1D:** Develop and implement a public outreach/education program regarding the illegal harvest.

***RATIONALE:*** *Actions taken to reduce stressors in this Ecological Management Zone are prescribed primarily to contribute to the recovery of aquatic species, such as winter-, spring-, and late-fall-run chinook salmon; green sturgeon; splittail; and steelhead. These actions will also contribute to the recovery of species, such as Swainson's hawk, greater sandhill crane, yellow-billed cuckoo, riparian brush rabbit, black rail, and giant garter snake (U.S. Fish and Wildlife Service 1996, San Francisco Estuary Project 1992b, Bay-Delta Oversight Council 1993, and California Department of Fish and Game 1991).*

## DISTURBANCE

**TARGET 1:** Reduce boat wakes near California clapper and black rail nesting areas in Suisun Marsh and San Francisco Bay from March to June to prevent destruction of nests and assist in the recovery of this listed species (◆).

**PROGRAMMATIC ACTION 1A:** Develop a cooperative program with local agencies to establish and enforce zones prohibiting boat wakes within 50 yards of California black rail nesting areas in Suisun Marsh and San Francisco Bay from March to June.

**PROGRAMMATIC ACTION 1B:** Develop a cooperative program with local agencies to establish and enforce zones prohibiting motorized boats in 5 miles of dead-end channels in Suisun Marsh and San Francisco Bay from March to June.

**PROGRAMMATIC ACTION 1C:** Develop a cooperative program with local agencies to establish and enforce zones prohibiting motorized boats in new, small channels in restored tidal fresh emergent wetlands.

***RATIONALE:*** *Clapper rail are particularly sensitive to disturbance and efforts to reduce jet ski traffic in critical areas for the rail would contribute to their recovery. Other actions taken to restore ecological processes and functions, increase and improve habitats, and reduce stressors in this Ecological Management Zone are prescribed primarily to contribute to the recovery of aquatic species, such as winter-, spring-, and late-fall-run chinook salmon; green sturgeon; splittail; and steelhead. These actions will also contribute to the recovery of species, such as the black rail (Madrone Associates 1980, Schlosser 1991, San Francisco Estuary Project 1992a, U.S. Fish and Wildlife Service 1978, Schlorff 1991, and Resources Agency 1976).*

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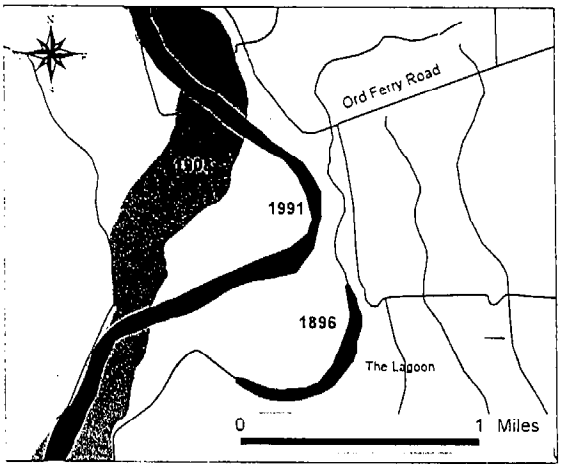
# ◆ SACRAMENTO RIVER ECOLOGICAL MANAGEMENT ZONE




Sacramento River channel south of Ord Ferry Bridge in 1896, 1908, and 1991 (Sacramento River Advisory Council, 1998).

## INTRODUCTION

The health of the Sacramento-San Joaquin Delta is dependent on the rivers and streams that compose its watershed. They provide inflow, sediments, nutrients, spawning and rearing areas for many aquatic species, and riparian corridors that support neotropical bird and other terrestrial wildlife, such as western yellow-billed cuckoo and bank swallow, and invertebrate species. Many estuarine fish species and their foodweb depend on the input from the Sacramento River. The Sacramento River is the largest element of the Delta's watershed, providing about 80% of the inflow to the Delta.

The Sacramento River is also an essential spawning, rearing, and migratory pathway for many anadromous fish populations, such as winter-run, fall-run, late-fall-run, and spring-run chinook salmon, steelhead, white sturgeon, green sturgeon, lamprey, striped bass, and American shad. All of these populations must pass through the Delta and Bay during portions of their life cycle as they migrate to the ocean as juveniles and return as adults to spawn.

Ecological factors having the greatest influence on the anadromous fish in the Sacramento River include streamflow, coarse sediment supply (including gravel for fish spawning and invertebrate production), stream channel dynamics (meander), and riparian and riverine aquatic habitat. Stressors, including dams, legal and illegal harvest, high water temperature during salmon spawning and egg incubation, toxins from mine drainage, hatchery stocking of anadromous fish, and unscreened or poorly screened irrigation diversions, have affected the health of anadromous fish populations.

## DESCRIPTION OF THE MANAGEMENT ZONE

The Sacramento River flows more than 300 miles from Lake Shasta to Collinsville in the Delta, where it joins the San Joaquin River. It is a major river of the western United States and the largest and most important riverine ecosystem in the State of California. The river corridor encompasses more than 250,000 acres of natural, agricultural, and urban lands upstream of Sacramento. Various cropland habitats occur on flat and gently rolling terrain adjacent to most of this zone. Irrigated crops are mostly rice, grains, alfalfa, and orchard crops. Most of this cropland is irrigated with water diverted from the Sacramento River or its tributaries. Five National Wildlife Refuges (Sacramento, Delevan, Colusa, Sacramento River and Sutter) are located either adjacent to or within 5 miles of the Sacramento River.

The Sacramento River Ecological Management Zone includes 242 miles of the mainstem Sacramento River from Keswick Dam near Redding to the American River at Sacramento. (The remaining 60 miles of the lower river downstream of Sacramento are included in the North Delta Ecological Management Unit.) The mainstem river planning area includes the river channel, gravel bars and vegetated terraces, the 100-year river floodplain, and the geologically defined band of historic and potential river migration (i.e., the meander belt). In the artificially narrow, leveed reach downstream of Colusa and extending to Sacramento, an approximately 1-mile-wide band of river alluvium and historic and potential forest land that borders the levees is also included in this Ecological Management Zone.

This Ecological Management Zone encompasses five Ecological Management Units:

- Keswick to Red Bluff Diversion Dam,
- Red Bluff Diversion Dam to Chico Landing,
- Chico Landing to Colusa,
- Colusa to Verona, and
- Verona to Sacramento.

The National Marine Fisheries Service (NMFS) has determined that critical habitat for the endangered Sacramento winter-run chinook salmon includes the entire Sacramento River from Keswick Dam, river mile (RM) 302 to the Golden Gate Bridge (NMFS 1993). The NMFS has also proposed that all Central Valley stream reaches that are accessible to steelhead be designated as critical habitat, except for the San Joaquin River and tributaries upstream of the Merced River confluence.

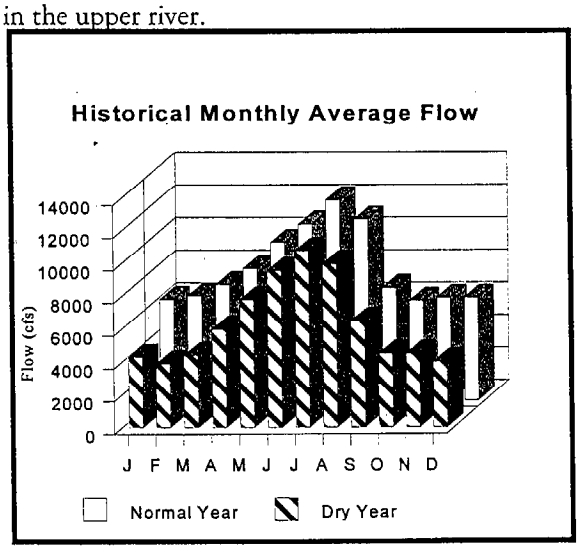
Other fish dependent on the Sacramento River Ecological Management Zone include spring-run chinook salmon, late-fall-run chinook salmon, fall-run chinook salmon, steelhead, lamprey, green sturgeon, white sturgeon, American shad, striped bass, and a resident native fish community, including the Sacramento splittail. Due to declining populations sizes, many of these are species of special concern or listed under provisions of the state or federal endangered species acts. One of the important attributes of the zone is its riparian forest, which supports a variety of neotropical migrant bird species, the valley elderberry longhorn beetle, and many other terrestrial species. The riparian vegetation is a significant contributor to the food web and large riparian forests effectively moderate air temperatures.

Sacramento River flow is controlled during much of the year by water releases at Keswick and Shasta dams. Tributaries, including many with no major storage dam, provide a significant quantity of flow accretion, particularly through winter and spring months. Prior to the construction of Shasta Dam, the river flows near Redding had a typical winter and spring high-flow period and a summer low-flow period. Dry-year flows typically reached a peak near a monthly average of 10,000 cubic feet per second (cfs) in March. In more normal years, peak flows reached approximately 20,000 cfs in March. Low summer flows averaged less than 5,000 cfs in dry and normal years.

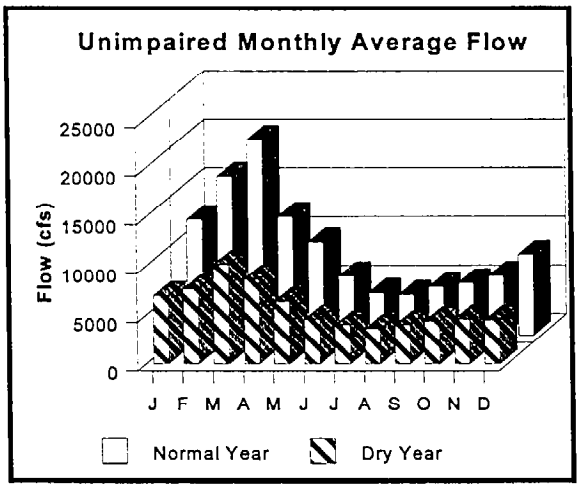
**Listing Status of Sacramento River Species**

| Species | Status of Listing |
|---|---|
| Winter-run chinook | ESA: endangered<br>CESA: endangered |
| Spring-run chinook | ESA: threatened<br>CESA: threatened |
| Late-fall chinook | ESA: candidate |
| Fall-run chinook | ESA: candidate |
| Steelhead | ESA: threatened |
| Green sturgeon | Species of Special Concern |
| Splittail | ESA: threatened |
| Bank swallow | CESA: threatened |
| Western yellow-billed cuckoo | CESA: endangered |
| Valley elderberry longhorn beetle | ESA: threatened |

Since completion of Shasta and Trinity dams, streamflows in the Sacramento River have changed markedly. Late-winter and spring flows in dry and normal years are stored in reservoirs and released during the late-spring through fall irrigation season. In addition to flows released for irrigation in recent years, flows in excess of 10,000 cfs have been augmented to assist in controlling temperature for survival of winter-, spring, and fall-run chinook salmon spawning, egg incubation, and early rearing in the upper river.




Historical Streamflow below Keswick Dam, 1972-1992
(Dry year is the 20th percentile year; normal year is the 50th percentile or median year.)




Unimpaired Streamflows below Keswick Dam, 1972-1992 (Dry year is the 20th percentile year; normal is the 50th percentile or median year.)

Several water development and flood control projects have dramatically altered the river's natural flow regime, sediment transport capabilities, and riparian and riverine habitats.

These projects include the Central Valley Project (CVP), which consists of Shasta, Keswick, and Whiskeytown dams and Red Bluff Diversion Dam (RBDD). They also include the Sacramento River Flood Control Project, which extends 180 miles south from Chico Landing and consists of a series of levees, weirs, and overflow areas, and the Chico Landing to Red Bluff Comprehensive Bank Stabilization Project, which is designed to control lateral river channel migration. This project is about 54% complete but has not been worked on since 1984. The State Water Project (SWP), consisting of Oroville Dam and the associated diversion works, has altered the flow regime below the confluence with the Feather River.

Natural sediments include fine suspended material that causes elevated turbidity to coarser materials that include gravel and cobbles. Bedload sediments also contribute to ecological health by absorbing energy of water and dampen the intensity of flood effects. Gravel recruitment is limited by dams blocking downstream gravel transport, bank protection, and gravel mining on tributaries. Deficiency in spawning gravels reduces the productive capacity of the river. This is especially true in the 15- to 20-mile river reach below Keswick Dam. Spawning gravel may be adequate to support present salmon and steelhead populations. As fish populations increase, gravel replenishment will be necessary. Natural gravel recruitment from tributary streams, particularly from Cottonwood Creek, needs to be protected to ensure that the gravel deficit in the upper main stem Sacramento River does not increase. Spawning gravel needs protection from degradation caused by excessive silt entering the river from the tributaries. Watershed protection and comprehensive watershed management plans are needed in all the tributaries to reduce erosion of silts and sands that impair the quality of spawning gravels.

The Sacramento River and its tributaries above Shasta Dam have a cold temperature regime suitable for year round salmon spawning. Although the salmon cannot access this reach of the ecosystem, the cold water can be managed using the reservoir and dam to replace the inaccessible upper portions of the watershed. Water temperature in the river is influenced by water releases from Shasta and Keswick dams in drought and consecutive dry or critically dry years. Low flows, combined with warmwater releases, cause the loss of many adult salmon and eggs spawned in the river.

Sacramento River temperature control and power generation requires the installation of a multilevel outlet structure on Shasta Dam and a minimum fall carryover storage in the reservoir of about 2 million acre-feet (MAF). Water temperature in the Sacramento River near Knights Landing can be improved by redirecting the Colusa Basin drain and other agriculture return water to a receiving water other than the Sacramento River or by reuse.

The Colusa Basin drain originates north of Willows in Glenn County. The drain captures waters from the two major diverters located on the west side of the Sacramento River, the Tehama-Colusa and Glenn-Colusa Irrigation districts in Glenn, Colusa, and Yolo counties. Much of the water conveyed through the drain is recaptured and reused before being discharged into the Sacramento River at Knights Landing near RM 90. The combined volume of the water delivered by the two districts can exceed 5,000 cfs during the peak of the irrigation season.

Water temperature is also affected by overhanging vegetation, which shades and moderates heat gain by the water. This shaded riverine aquatic (SRA) habitat has been significantly altered by bank protection and flood control projects. Reestablishing this edge vegetation would significantly improve SRA habitat, woody debris, and other riparian habitat along the

Sacramento River, which, in turn, should improve production and survival of salmon and steelhead.

Historically, the riparian forest corridor along the river averaged 4 to 5 miles wide and encompassed a significantly large area. Today only 5% of the forests remain. One-third of the river length has natural banks and floodplain terraces; the other two-thirds have been modified and confined by levees, riprap, and flood control projects. These structures limit the dynamic forces that promote natural habitat succession and regeneration along the river. Channelization and bank protection between Red Bluff and the Delta eliminate and degrade many habitats by increasing the depth and velocity of flow and reducing the hydraulic and substrate diversity associated with more natural or undeveloped river systems. Bank protection also reduces the amount of fresh gravel and shaded riverine aquatic habitat normally available to the river through bank erosion.

Between Colusa and Red Bluff, natural riparian vegetation associated with the existing stream meander corridor plays a part in the natural floodplain process. In turn, the diversity of streamside vegetation and its overall condition are dependent on these same dynamic river processes. Riparian vegetation effectively creates a buffer to decrease local flood flow velocities. This increases deposits of suspended materials derived from eroding banks. This erosion-deposition process builds the midterrace and eventually the high-terrace lands that support climax forest and agriculture. Overbank flooding is essential for the continued health of the riparian system. As silt and seeds are deposited during these overbank water flow events, the native vegetation is rejuvenated.

The fragmentation of the remaining riparian habitat greatly diminishes its ability to support viable wildlife populations. This remaining habitat is being further degraded by human activity and adverse land uses. The combined loss, fragmentation, and deterioration of riparian habitat has caused, or is leading to, the extinction or elimination of several wildlife species. The drastic decline of the Swainson's hawk, once one of California's most abundant raptors, is in part a result of the loss of riparian nesting areas. In 1987, surveys documented such a low number of yellow-billed cuckoos, that the species appeared to be in danger of immediate extirpation. The elimination of the bank swallow appears likely if bank protection work continues and if mitigation measures are unsuccessful. Various other animal species and some plant species, including the rose-mallow, have population viability problems as a result of adverse human impacts on riparian habitat.

Reestablishing a viable riparian ecosystem along the upper Sacramento River region will increase the acreage and variety of riparian habitats and reverse the decline in wildlife, fishery, and human use values. The U.S. Fish and Wildlife Service (USFWS), the Wildlife Conservation Board (WCB), the National Audubon Society, The Nature Conservancy (TNC), and other private conservation groups are actively seeking to acquire conservation easements or fee ownership of high-priority riparian lands along the Sacramento River as a means to save these lands permanently.

More than 100 miles of the Sacramento River between Red Bluff and Colusa are wholly or partially intact as a dynamic alluvial river meander belt. Although about 20% of its banks are armored by riprap that protects levees and orchards, the river continues to erode its banks naturally and form new banks from gravel and sediment deposits on point bars and terraces. These fluvial geomorphic features support a time-dependent succession of young- and old-growth forest and wildlife habitat that requires 65 to 100 years to reach full maturity (climax succession to valley oak woodland). New sediment and gravel that sustain this process are supplied by a combination of eroding banks along the mainstem river and input from unregulated upstream tributaries. New fish habitat is continually created by migrating gravel riffles and deeper pools formed at bendways, and by mature trees and roots that overhang or topple into the channel as the river naturally erodes through older alluvial deposits supporting climax vegetation.

Improvements in the riparian and stream meander corridors along the Sacramento River are needed to improve spawning and early rearing habitat of splittail. Late-winter and early-spring streamflow improvements are needed to provide attraction flows for spawning adults and increased spawning habitat. Increasing flows in early spring also assists in successful migration of juvenile chinook salmon and steelhead.

Improved peak flows in late winter and early spring are needed to benefit sturgeon spawning. Improved stream meander corridors should also benefit sturgeon.

All four races of chinook salmon require improved streamflows, gravel recruitment, water temperatures, riparian and riverine aquatic habitat, and stream meander corridors, and reduction in the adverse effects of stressors, such as high water temperatures, unscreened diversions, contaminants, and harvest.

Steelhead require improved streamflows and gravel recruitment in the upper river and improved water temperature and riverine habitat in the upper, middle, and lower reaches of the river. Restoring and maintaining natural flow patterns will benefit chinook salmon, but steelhead will benefit only if the natural flows also provide suitably cold water to support year round rearing of juvenile fish. Because of the placement of impassable dams on all major tributaries, approximately 82% to 95% of historical Central Valley steelhead habitat is now inaccessible (Yoshiyama et al. 1996) hence natural populations are mostly relegated to spawning and rearing in low elevation habitats that were historically used mostly as migration corridors. Because of increased summer and fall hypolimnetic releases from reservoirs, flow and temperature conditions in the late summer and fall periods in these reaches can be more beneficial to steelhead than before the dams were built, and small numbers of natural steelhead are able to sustain themselves in these tailwater habitats because of this. Inhospitable conditions in the lower reaches in the pre-dam years was not an overriding impact to steelhead because they had access to the cooler water habitats of the mid and high elevation tributaries.

Striped bass spawning in the Sacramento River is controlled by water temperatures. Fertilized striped bass eggs require sufficient stream flows and velocities to maintain the eggs in suspension.

Improvements in late-winter and spring streamflows and stream meander corridors are needed to benefit American shad spawning and rearing in the Sacramento River.

The yellow-billed cuckoo along the Sacramento River above the Delta is not a species for which specific restoration projects are proposed. Potential habitat for the cuckoo will be improved by improvements in riparian habitat areas that result from efforts to protect, maintain, and restore riparian and riverine aquatic habitats throughout the Sacramento River Ecological Management Zone, sustaining the river meander belt, and increasing the coarse sediment supply to support meander and riparian regeneration.

Specific restoration projects are not proposed for the bank swallow populations along the Sacramento River above the Delta. Potential habitat for bank swallows will be improved by sustaining the river meander belt, and increasing the coarse sediment supply to support meander and coarse sediment erosion and deposition processes.

**LIST OF SPECIES TO BENEFIT FROM RESTORATION ACTION IN THE SACRAMENTO RIVER ECOLOGICAL MANAGEMENT ZONE**

- splittail
- green sturgeon
- white sturgeon
- chinook salmon
- steelhead trout
- striped bass
- American shad
- western yellow-billed cuckoo
- bank swallow
- neotropical migratory birds
- valley elderberry longhorn beetle

Other problems in the Sacramento River affecting anadromous fish include poorly screened diversions, seasonal dams installed in rivers, small unscreened diversions, and a limited number of large diversions (>250 cfs). Two diversion dams operate on the river seasonally: Anderson-Cottonwood Irrigation District's (ACID) flashboard dam in Redding that diverts approximately 400 cfs and partially impairs the upstream and downstream migration of salmon and steelhead, and RBDD, the gates of which are in place from mid-May to mid-September to allow diversions up to 3,000 cfs into the Corning Canal and Tehama Colusa Canal. Both the dams and diversions have fish passage facilities and fish screens. Fish passage facilities are inadequate at both facilities, and the screen system at the ACID diversion is not adequate. Although predation problems associated with the dams have been lessened, they still occur.